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(11) **EP 1 317 981 A1**

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.06.2003 Bulletin 2003/24

(51) Int Cl.7: **B23B 29/24**

(21) Application number: **02445163.5**

(22) Date of filing: **02.12.2002**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

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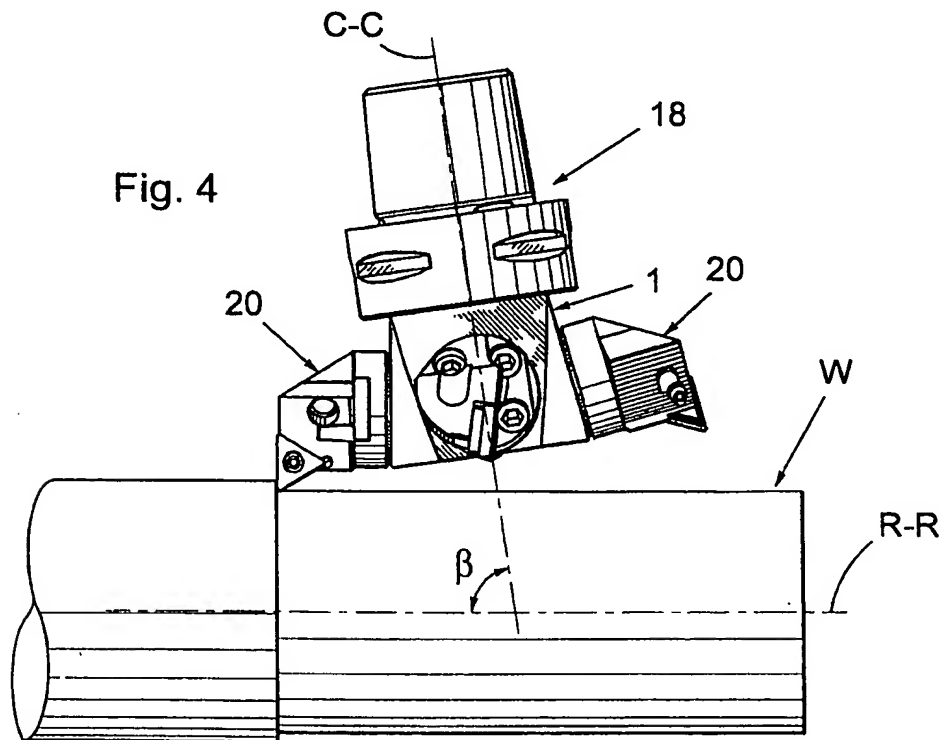
(30) Priority: **10.12.2001 SE 0104130**

(54) Tool Holder

(57) The present invention relates to a tool holder, which is intended to simultaneously carry at least two diametrically arranged tool heads (20), which carry cutting inserts for chip removing machining, the tool holder comprising an adaptor (1) and a coupling (18). The invention also separately relates to the adaptor (1).

Characteristic of the tool holder according to the

present invention is that the adaptor (1) has at least two diametrically opposite side surfaces (3), which diverge in the direction from the coupling (18), that the side surfaces (3) have members (10) in order to replaceably receive a tool head (20), and that a line (L) which is situated in a first basal plane (BP1) and in one of the side surfaces (3) forms an angle (α) in the interval 1° - 15° to a longitudinal centre line C-C for the tool holder.



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DescriptionTechnical Field of the Invention

[0001] The present invention relates to a tool holder, which is intended to simultaneously carry at least two diametrically arranged tool heads, which carry cutting inserts for chip removing machining, the tool holder comprising an adaptor and a coupling. The invention also relates separately to an adaptor included in the tool holder.

Prior Art

[0002] An embodiment of a tool which has three serrated surfaces, two of which are preferably parallel to each other and the third surface has an extension perpendicularly to the two parallel surfaces holder is previously known from US-A-6 244 780. All of said three surfaces have members for receipt of a tool head, said members in this case consisting of holes, in which a drawbar of the tool head is intended to be received. The tool holder according to US-A-6 244 780 is not intended to carry a plurality of tool heads simultaneously.

Objects and Features of the Invention

[0003] A primary object of the present invention is to provide a tool holder of the kind defined in the introduction and which simultaneously can carry at least two substantially diametrically arranged replaceable tool heads, said tool heads being arranged in a way which ensures that they do not interfere with the workpiece when chip removing machining is carried out with any one of the tool heads.

[0004] Another object of the present invention is to ensure that the tool holder should preferably carry a relatively large number of replaceable tool heads, whereby switching between different tool heads can be effected exceptionally quickly.

[0005] Yet another object of the present invention is to provide an exceptionally exact positioning of the replaceable tool heads on the tool holder.

[0006] At least the primary object is realised by means of a tool holder having the features defined in the subsequent independent claim 1. Preferred embodiments of the invention are defined in the dependent claims.

Brief Description of the Drawings

[0007] Embodiments of the invention will be described below, reference being made to the accompanying drawings, where:

Fig 1 shows a perspective view of a first embodiment of an adaptor that is included in the tool holder according to the present invention;

Fig 2 shows a planar view from above of the adaptor according to Fig 1;

Fig 3 shows a side view of a tool holder according to the present invention, which is equipped with a number of replaceable tool heads;

Fig 4 shows a side view of the tool holder equipped with a number of replaceable tool heads according to Fig 3 during chip forming machining of a rotating workpiece, the axis of rotation of the workpiece being in the plane of the paper;

Fig 5 shows a view, somewhat in perspective, of the tool holder according to the present invention during chip forming machining of the workpiece illustrated in Fig 4, the axis of rotation of the workpiece extending perpendicularly to the plane of the paper;

Fig 6 shows a perspective view of a second embodiment of an adaptor that is included in the tool holder according to the present invention;

Fig 7 shows a planar view of the adaptor according to Fig 6;

Fig 8 shows a side view of a tool holder according to the present invention equipped with replaceable tool heads, in which tool holder the adaptor according to Figs 6 and 7 is included, a tool head of the tool holder performing chip removing machining of a rotating workpiece, where the axis of rotation of the workpiece is in the plane of the paper;

Fig 9 shows a view from above, somewhat in perspective, of the tool holder equipped according to Fig 8, a tool head of the tool holder performing chip removing machining of a rotating workpiece, where the axis of rotation of the workpiece is in the plane of the paper; and

Fig 10 shows a schematic side view of additionally one alternative embodiment of the tool holder according to the present invention, which tool holder is equipped with a number of tool heads.

50 Detailed Description of Preferred Embodiments of the Invention

[0008] The adaptor 1 illustrated in Figs 1 and 2 comprises four side surfaces 3, a contact surface 5 as well as a front surface 7, see Fig 5, which is parallel to the contact surface 5. Generally triangular, bridging surfaces 9 are arranged between adjacent side surfaces 3, which bridging surfaces are somewhat curved and po-

sitioned in the neighbourhood of the corners of the adaptor 1.

[0009] Each one of the side surfaces 3 has a mounting area 10, which in the embodiment illustrated is circular and provided with ridged teeth 11. A first centre hole 12 as well as four threaded anchor holes 13 are arranged in the mounting area 10, and they are all arranged symmetrically around the centre hole 12, which is intended for supply of cooling medium.

[0010] A circular cylindrical recess 14 as well as a groove 15 are arranged in the contact surface 5, which is intended to come to abutment against a co-operating surface in a coupling. The circular cylindrical recess 14 has an extension from the contact surface 5 in the direction of the front surface 7, the recess 14 having a certain depth due to the fact that the inner end thereof is defined by a step 16, which has a radial extension in respect to a longitudinal centre line C-C for the recess 14. A second centre hole 17 which is a through hole extends from the step 16 and penetrates the front surface 7.

[0011] The groove 15 penetrates two opposite side surfaces 3 and is centred in respect to said opposite side surfaces 3.

[0012] In order to facilitate the description of the mutual orientation of the surfaces of the adaptor 1 as well as the relevant parts of the replaceable tool heads, see Figs 3-5, which are intended to be brought into contact with the adaptor 1, a number of basal planes are inserted in Figs 1-5. A first basal plane BP1 contains the centre line C-C, which is situated at the centre of the groove 15 and divides the adaptor 1 into two equally large, mirror-inverted halves. A second basal plane BP2 also contains the centre line C-C as well as having an extension perpendicular to the first basal plane BP1, i.e. the second basal plane BP2 also divides the adaptor 1 into two equally large, mirror-inverted halves. A third basal plane BP3 contains the contact surface 5, i.e. the third basal plane BP3 has an extension parallel to the plane of the paper in Fig 2.

[0013] Opposite side surfaces 3 are not parallel to each other but diverge from each other in the direction from the contact surface 5 towards the front surface 7. A line L which is situated in the first basal plane BP1 and in one of the opposite side surfaces 3 which are penetrated by the groove 15 forms an angle α to the centre line C-C, wherein $1^\circ < \alpha < 15^\circ$ and is preferably $2,5^\circ < \alpha < 7,5^\circ$. The line L is shown in Fig 3 where the first basal plane BP1 is parallel to the plane of the paper. The other side surfaces 3 of the adaptor 1 have the same inclination in relation to the centre line C-C.

[0014] The adaptor 1 is connected, as shown in Figs 3-5, to a coupling 18, whereby the tool holder according to the present invention is obtained. The coupling 18 has a male part (not shown) that is received in the recess 14. An anchor bolt 19 extends through the second centre hole 17 and into a threaded hole on the male part, whereby the contact surface 5 is brought into contact

with a co-operating surface of the coupling 18. The coupling 18 is also provided with driver members 20, which are received in the grooves 15 in order to provide a joint suitable for the rotation between the adaptor 1 and the coupling 18. The centre line C-C also constitutes centre line for the coupling 18, and thereby also for the tool holder according to the present invention.

Replaceable tool heads which may be of standard type since the mounting areas 10 have been formed to co-operate with tool heads 20 of standard type 20 are applied on the mounting area 10 of the adaptor 1. The replaceable tool heads 20 are anchored on the mounting areas 10 by means of a screw joint, i.e. screws 21 extend into the anchor holes 13. Ridged teeth which co-operate the ridged teeth 11 which are arranged on the mounting surface 10 are arranged on the surface of the tool heads 20 that is intended to co-operate with the apurtenant the mounting surface 10. Thereby, an exceptionally inelastic anchorage of the tool heads 20 on the adaptor 1 is obtained.

[0015] Figs 4 and 5 show how the tool holder according to the present invention is oriented when a tool head performs chip-removing machining on the rotating workpiece W. In that connection, the centre axis C-C of the tool holder does not form a right angle to the rotation axis R-R of the workpiece W but the angle β which is formed is smaller than 90° . This means that the tool head 20 that is opposite the active tool head 20 is distanced a certain distance from the workpiece W. This is the result of the fact that the active tool head should be have a certain orientation in relation to the workpiece W and that the side surfaces 3 of the adaptor 1 have the above-described inclination. By studying Figs 4 and 5, it is realized that the tool holder according to the present invention can be indexed in a simple way, i.e. be rotated around the shaft C-C, wherein another tool head 20 becomes active. In this connection, it should be pointed out that the indexing can be effected without the angle β having to be changed.

[0016] An alternative embodiment of an adaptor 101 according to the present invention is shown in Figs 6 and 7. As can be seen in Figs 6 and 7, the adaptor 101 has five side surfaces 103, a contact surface 105 and a front surface (not shown), which is parallel to the contact surface 105. Between adjacent side surfaces 103, bridging surfaces 109 are arranged, which are composed of generally triangular and rectangular portions as well as situated in the area of the corner of the adaptor 101.

[0017] Each one of the side surfaces 103 has a mounting area 110, which in principle is identical to the mounting area 10 of the embodiment according to Figs 1-2, i.e. circular and provided with ridged teeth 111. A first centre hole 112 as well as four threaded anchor holes 113 which are arranged symmetrically around the centre hole 112 are arranged in the mounting area 110.

[0018] A circular cylindrical recess 114 as well as a groove 115 which is intended to come to abutment

against a co-operating surface in a coupling are arranged in the contact surface 105. The circular cylindrical recess 114 has an extension from the contact surface 105 in the direction of the front surface, the recess 114 having a certain depth due to the fact that the inner end thereof is defined by a step 116, which has a radial extension in respect to a longitudinal centre line C-C for the recess 114. A second centre hole 117 which is a through hole extends from the step 116 and penetrates the front surface.

[0019] Three basal planes BP1, BP2 and BP3 are indicated in Figs 6 and 7, in the same way as in Figs 1 and 2. The first basal plane BP1 divides the adaptor 101 into two equally large, mirror-inverted halves. The second basal plane BP2 divides the adaptor 101 into two halves that are not mirror-inverted. The third basal plane BP3 contains the contact surface 105 and is parallel to the plane of the paper in Fig 7.

[0020] The side surfaces 103 diverge from the centre line C-C in the direction from the contact surface 105 towards the front surface. A line L which is situated in the first basal plane BP 1 and in the side surface 103 which is penetrated by the groove 115 forms an angle α to the centre line C-C, wherein $1^\circ < \alpha < 15^\circ$ and is preferably $2,5^\circ < \alpha < 7,5^\circ$. The line L is shown in Fig 6 and 8, in Fig 8 the first basal plane BP1 being parallel to the plane of the paper. The other side surfaces 103 of the adaptor 101 has the same inclination in relation to the centre line C-C.

[0021] The tool holder according to the present invention is shown in Figs 8 and 9, the tool holder thus comprises the adaptor 101 and a coupling 18 which may be identical with the coupling 18 according to Figs 4-5, is equipped with five tool heads 20, which thus may be identical with the tool heads 20 in illustrated Figs 3-5 and preferably of a standard embodiment. The maximum number of tool heads 20 equals the number of side surfaces 103. As is seen especially clear in Fig 9, the tool heads 20 are not directly opposite each other, however, it is necessary that the two tool heads 20 which are situated on opposite side of the adaptor 101, in comparison with the active tool head 20, are distanced from the workpiece W since they would otherwise interfere with said workpiece W.

[0022] The embodiment illustrated in Fig 10 comprises an adaptor 201 which is "double-conical", i.e. in addition to the first side surfaces 203 which diverge in a direction away from the contact surface 205 towards the adaptor 201 it also comprises second side surfaces 204, which converge very strongly in a direction away from the contact surface 205. A line L that is parallel to the plane of the paper in Fig 10 and is situated in a first side surface 203, inclined at a corresponding angle α in relation to the centre line C-C as in the above-described embodiments, i.e. $1^\circ < \alpha < 15^\circ$. In that connection, a first basal plane BP1 is parallel to the plane of the paper in Fig 10, said basal plane BP1 dividing the appurtenant first side surface 203 exactly in two halves. As for the

inclination of the second side surfaces 204, the angle γ which is contained between meeting first and second side surfaces 203, 204 is in the interval 70° - 90° . In the embodiment according to Fig 10, the number of first and second side surfaces 203, 204 may vary according to what is said below under the heading **Feasible Modifications of the Invention**, wherein, however, the number of first side surfaces 203 should be equal to the number of second side surfaces 204. As is shown in Fig 10, both the first side surfaces 203 and the second side surfaces 204 may be equipped with tool heads 20, preferably of standard embodiment.

Feasible Modifications of the Invention

[0023] In the embodiments illustrated above, the adaptor 1; 101 is provided with four and five side surfaces 3; and 103, respectively. However, within the scope of the present invention, it is also conceivable that the adaptor is provided with two diametrically opposite side surfaces or more than five side surfaces. The fact that the case where the adaptor is provided with three side surfaces has been excluded, depends on the fact that the inactive tool heads in this case normally do not interfere with the workpiece.

[0024] In the above-described embodiments, the adaptor 1; 101 and the coupling 18 are two separate units that are connected in a suitable way. Within the scope of the present invention, it is also conceivable that the adaptor and the coupling are integrated into one unit.

[0025] In the above-described embodiments, all side surfaces 3; 103 have the same inclination in relation to the centre line C-C. However, it is conceivable within the scope of the present invention that the side surfaces 3; 103 have different inclinations in relation to the centre line C-C. With an exemplifying and not limiting aim, it is conceivable that a side surface has a deviating inclination while the rest of the side surfaces have the same inclination relatively the centre line C-C. Alternatively, it is conceivable that all side surfaces have different inclinations relatively the centre line C-C. In case the side surfaces have different inclinations, the angle β in, for instance, Fig 4 has to be changed when the tool holder is indexed.

[0026] In the above-described embodiments, the mounting areas 10; 110 are provided with ridged teeth 11; 111 and anchor holes 13; 113 for a satisfactory mounting of the tool heads 20 on the adaptor 1; 101; 201. However, alternative members are conceivable within the scope of the present invention that enable mounting of tool heads on an adaptor according to the present invention. With an exemplifying and not limiting aim, as alternatives to the mounting members illustrated in the embodiments according to the above, splines, different types of cones, drawbars and centre bolts may be mentioned.

List of Reference Designations**[0027]**

1; 101; 201	Adaptor
3; 103; 203	Side surfaces
204	Second side surfaces
5; 105; 205	Contact surface
7; 107	Front surface
9; 109	Bridging surfaces
11; 111	Ridged teeth
12; 112	First centre hole
13; 113	Anchor holes
14; 114	Circular cylindrical recess
15; 115	Groove
16; 116	Step
17; 117	Second centre hole
18	Coupling
19	Anchor bolt
20	Tool head
21	Screws

Claims

1. Tool holder, which is intended to simultaneously carry at least two diametrically arranged tool heads (20), which carry cutting inserts for chip removing machining, the tool holder comprising an adaptor (1; 101; 201) and a coupling (18), **characterized in that** the adaptor (1; 101; 201) has at least two diametrically opposite side surfaces (3; 103; 203), which diverge in the direction from the coupling (18), that the side surfaces (3; 103; 203) have members (10; 110) in order to replaceably receive a tool head (20), and that a line (L) which is situated in a first basal plane (BP1) and in one of the side surfaces (3; 103; 203) forms an angle (α) in the interval 1° - 15° to a longitudinal centre line C-C for the tool holder.

2. Tool holder according to claim 1, **characterized in that** all side surfaces (3; 103; 203) have the same inclination (α) in relation to the centre line (C-C).

3. Tool holder according to claim 1 or 2, **characterized in that** $2,5^\circ < \alpha < 7,5^\circ$.

4. Tool holder according to any one of the preceding claims, **characterized in that** the adaptor (1; 101; 201) is detachably connected to the coupling (18).

5. Tool holder according to any one of claims 1-3, **characterized in that** the adaptor (1; 101; 201) is integral with the coupling (18).

6. Tool holder according to any one of the preceding claims, **characterized in that** the member (10; 110)

for replaceably receiving a tool head (20) comprises ridged teeth (11; 111) which are intended to co-operate with ridged teeth on the tool heads (20).

7. Tool holder according to any one of the preceding claims, **characterized in that** the adaptor (201) has additional side surfaces (204), which connect to the first side surfaces (203) and converge in a direction from the coupling (18).

8. Adaptor (1; 101; 201) intended to be included in a tool holder, the adaptor (1; 101; 201) being intended to simultaneously carry at least two diametrically arranged tool heads (20), which carry cutting inserts for chip removing machining, **characterized in that** the adaptor (1; 101; 201) has at least two diametrically opposite side surfaces (3; 103; 203), that the side surfaces (3; 103; 203) have members (10; 110) in order to replaceably receive a tool head (20), and that a line (L) which is situated in a first basal plane (BP1) and in one of the side surfaces (3; 103; 203) forms an angle (α) in the interval 1° - 15° to a longitudinal centre line C-C for the adaptor.

9. Adaptor (1; 101; 201) according to claim 8, **characterized in that** all side surfaces (3; 103; 203) have the same inclination (α) in relation to the centre line (C-C).

10. Adaptor (1; 101; 201) according to claim 8 or 9, **characterized in that** $2,5^\circ < \alpha < 7,5^\circ$.

Fig. 1

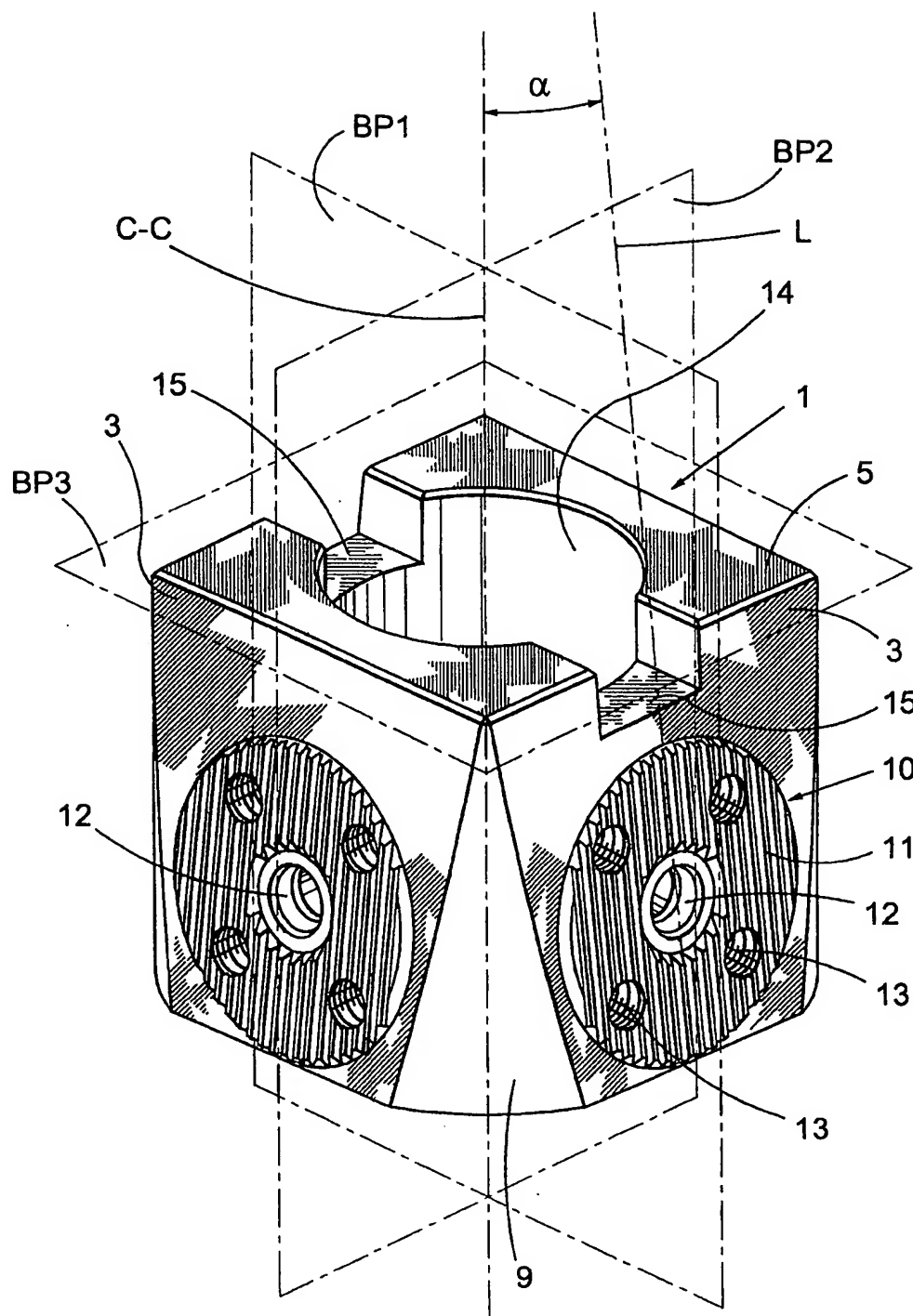
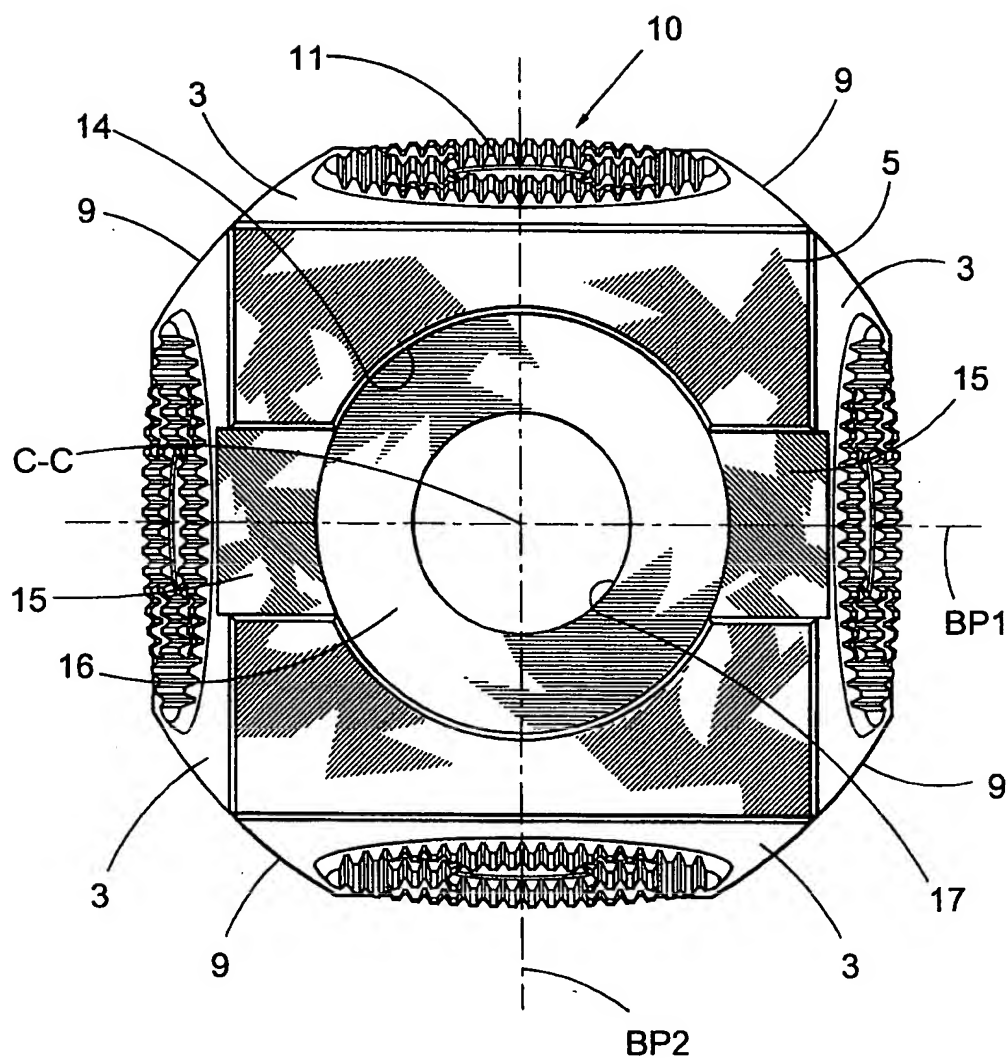
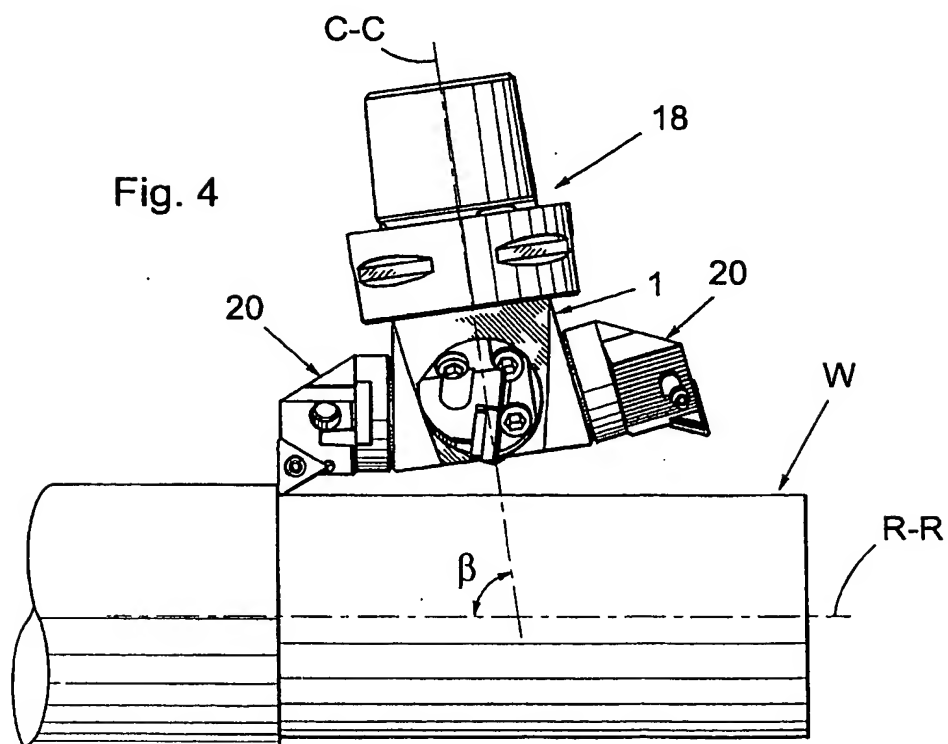
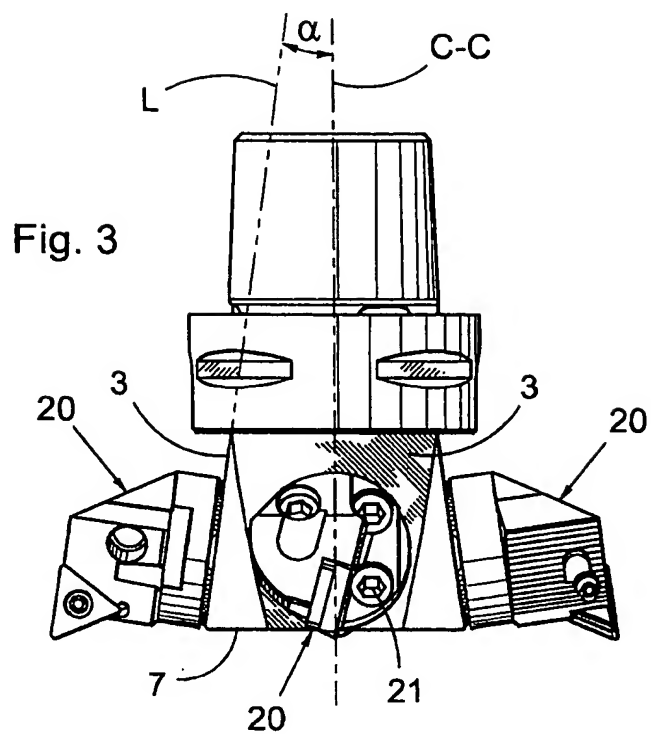


Fig. 2





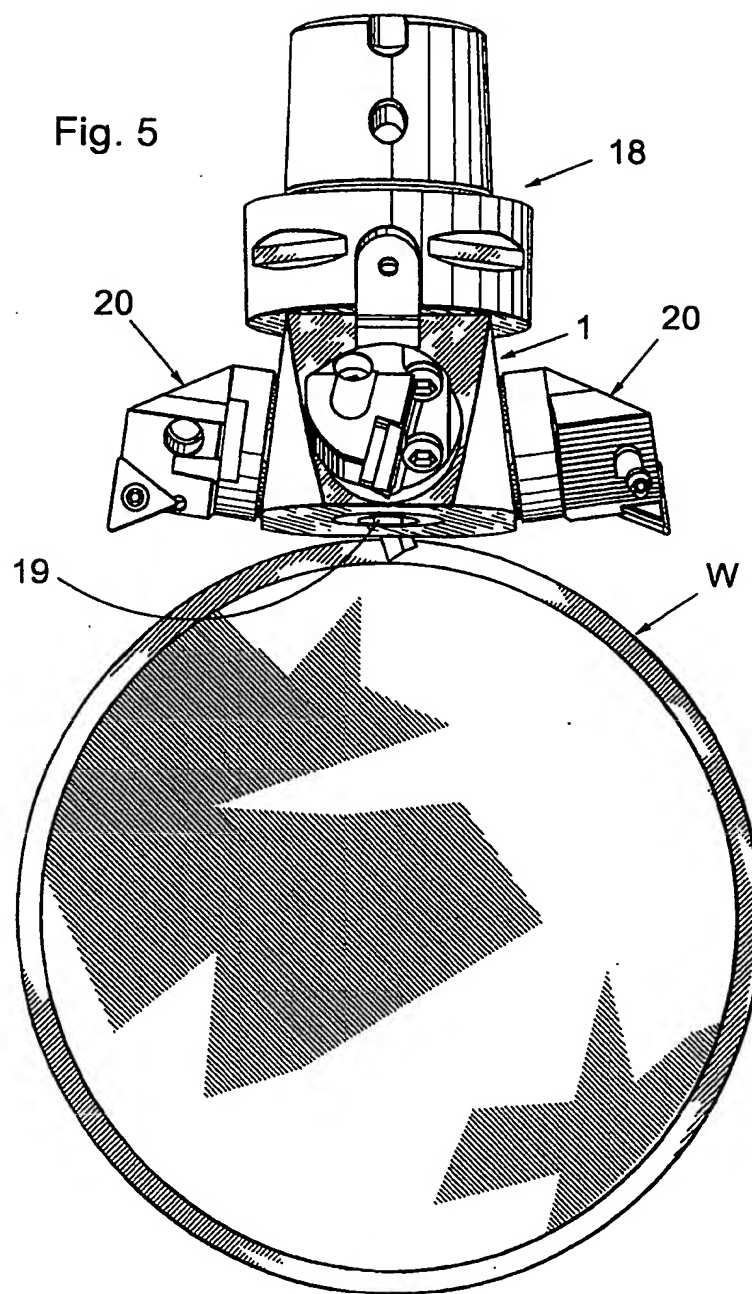


Fig. 6

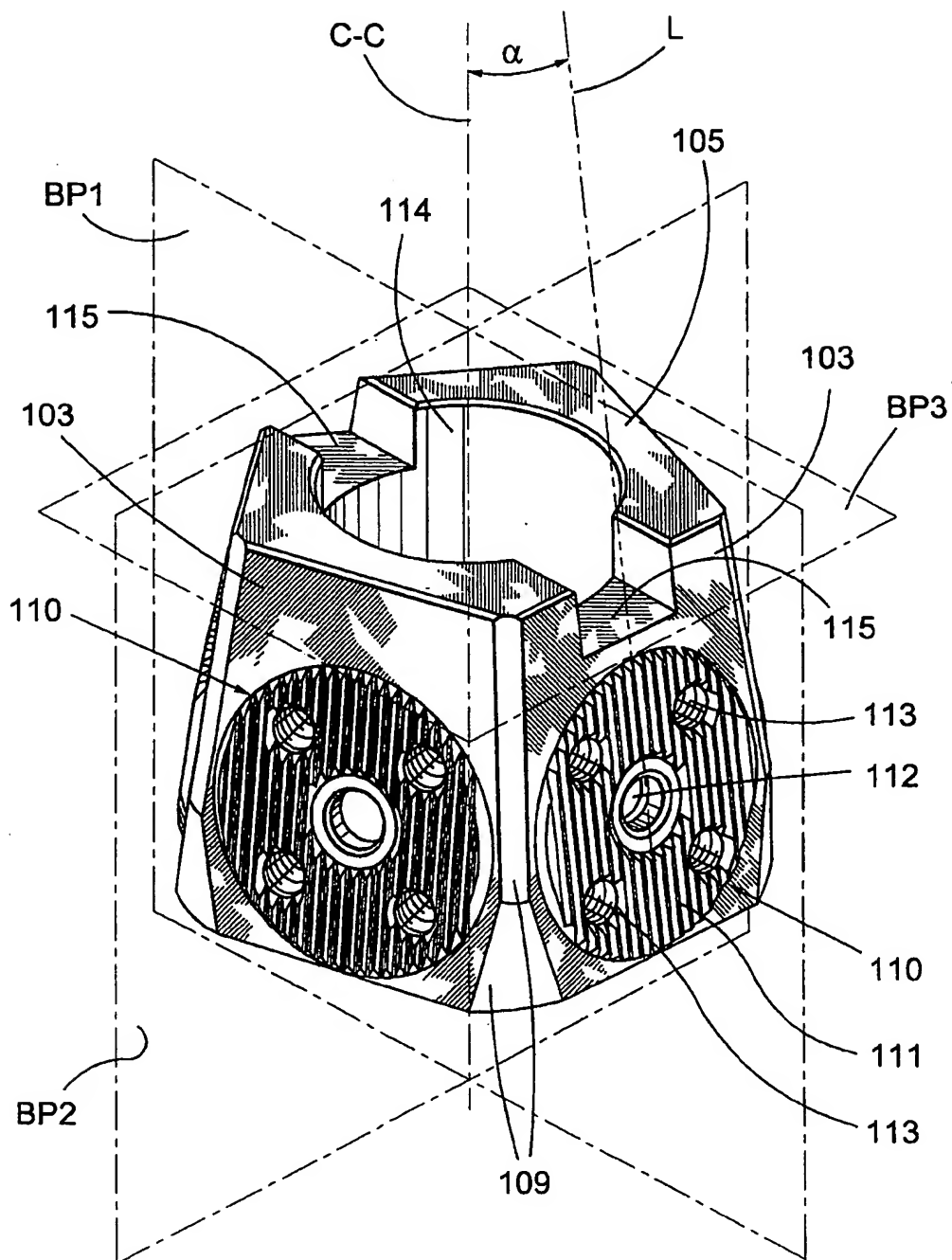


Fig. 7

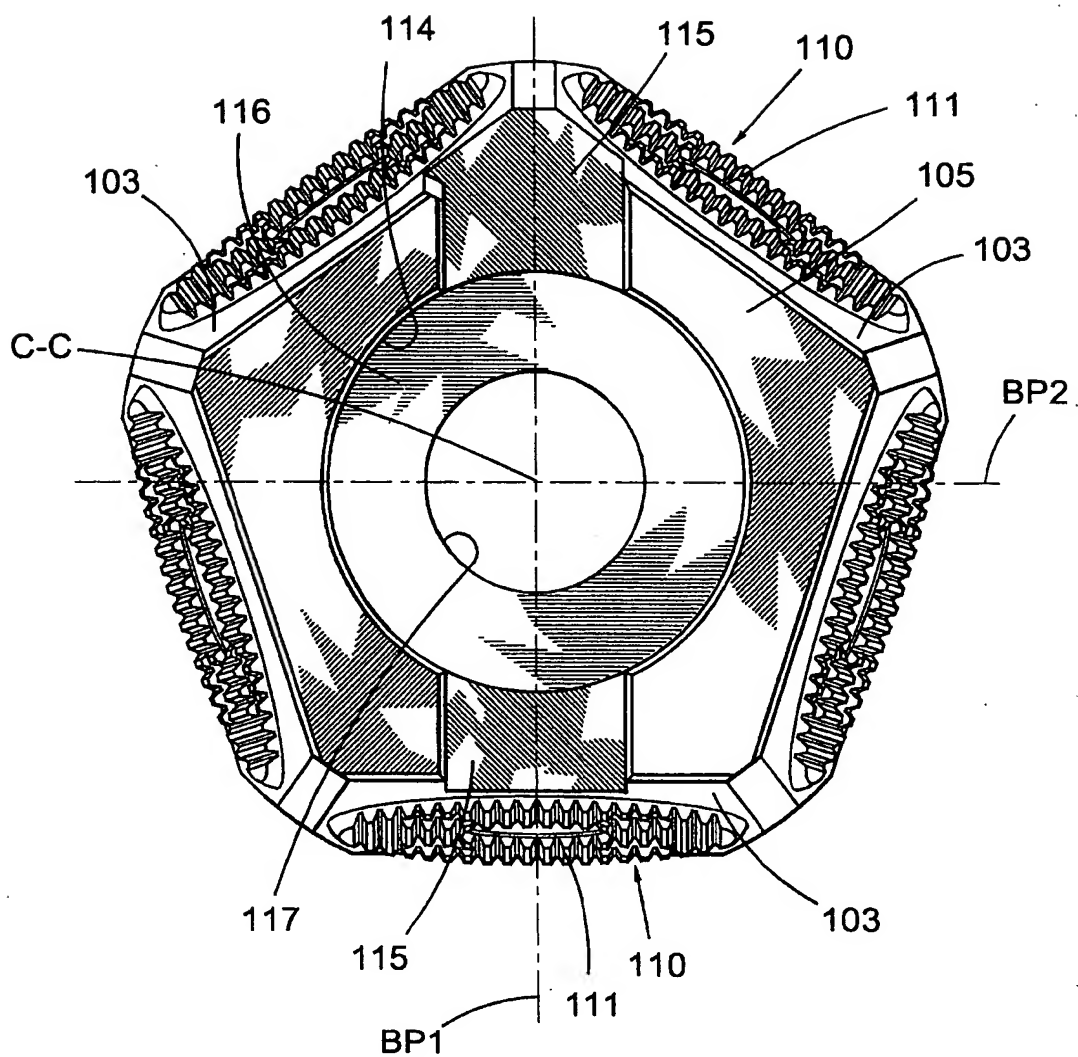
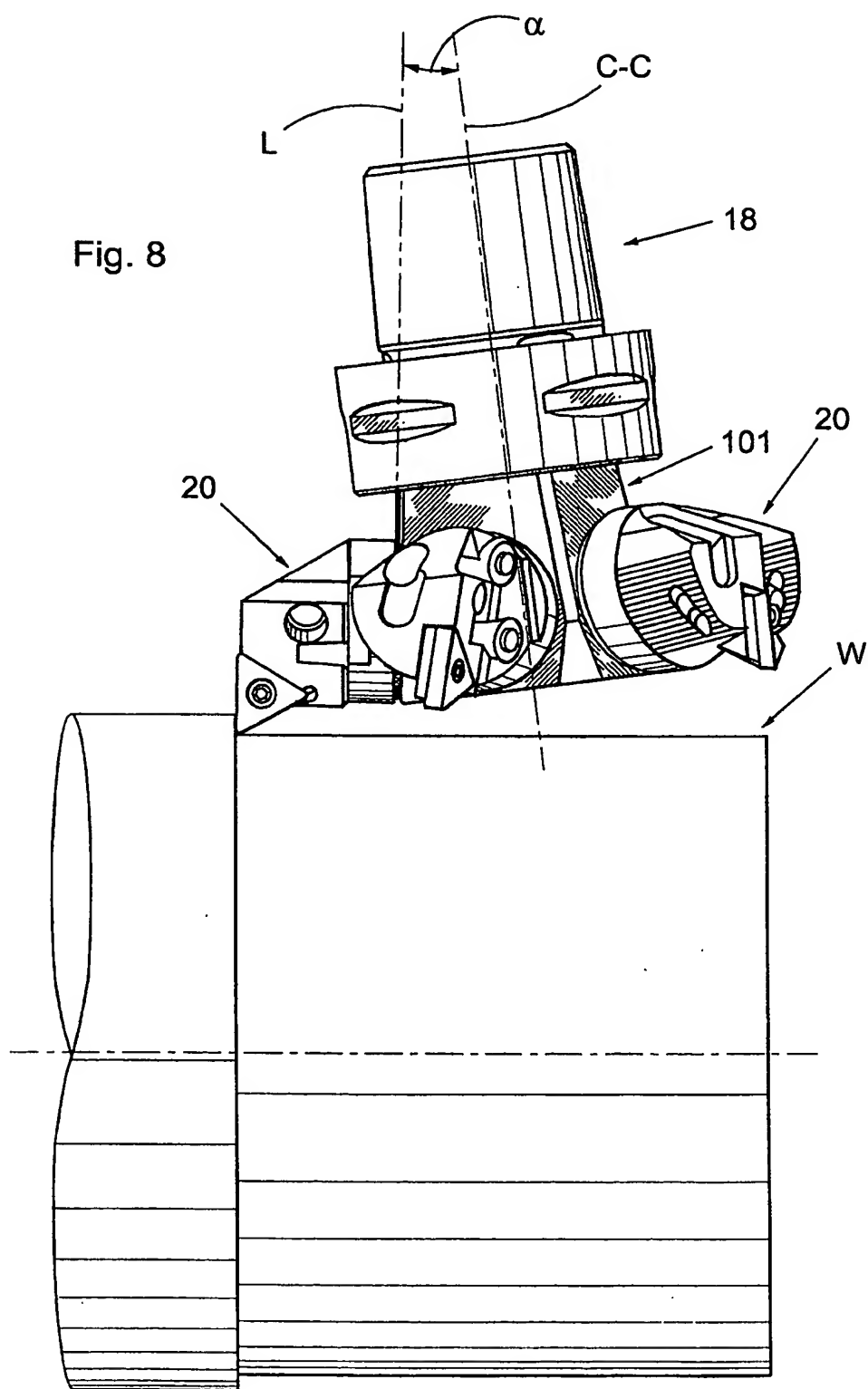
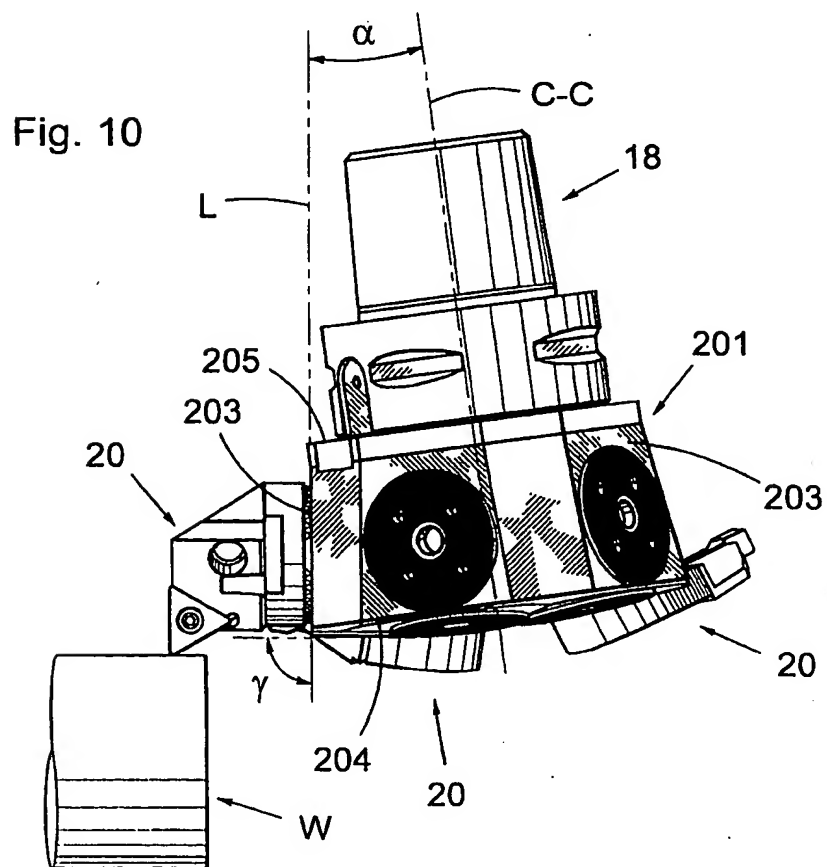
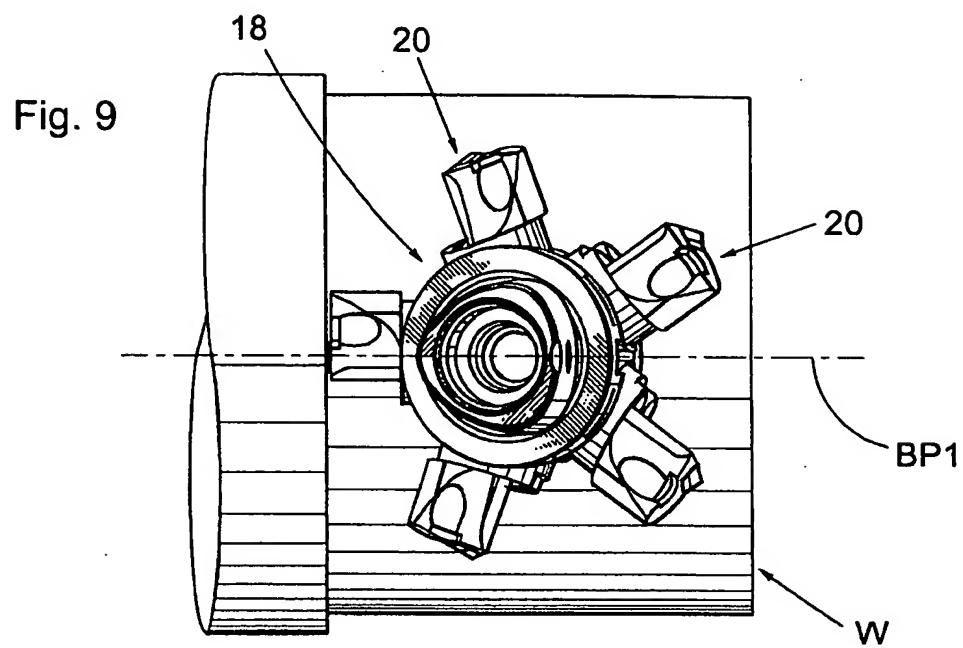


Fig. 8







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EUROPEAN SEARCH REPORT

Application Number
EP 02 44 5163

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
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Place of search THE HAGUE		Date of completion of the search 7 March 2003	Examiner Fiorani, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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